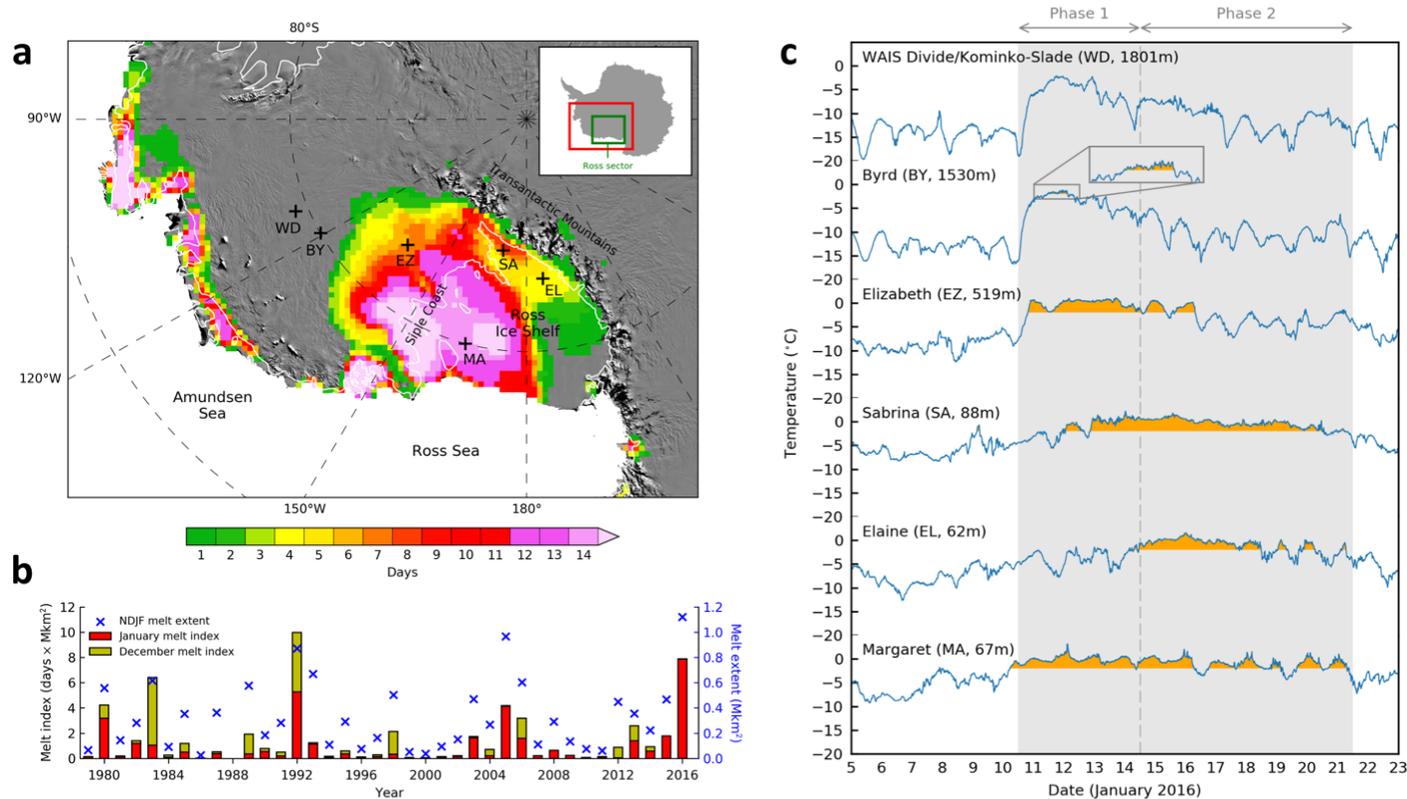


AWARE Summary, Aerosol Results and Next Steps for ASR/ARM in the Antarctic

First AWARE Major Case Study: January 2016 Melt Event on West Antarctica

- Perhaps and analogy of transition from current to warming climate
- See Nicolas et al., 2017: *Nature Communications*

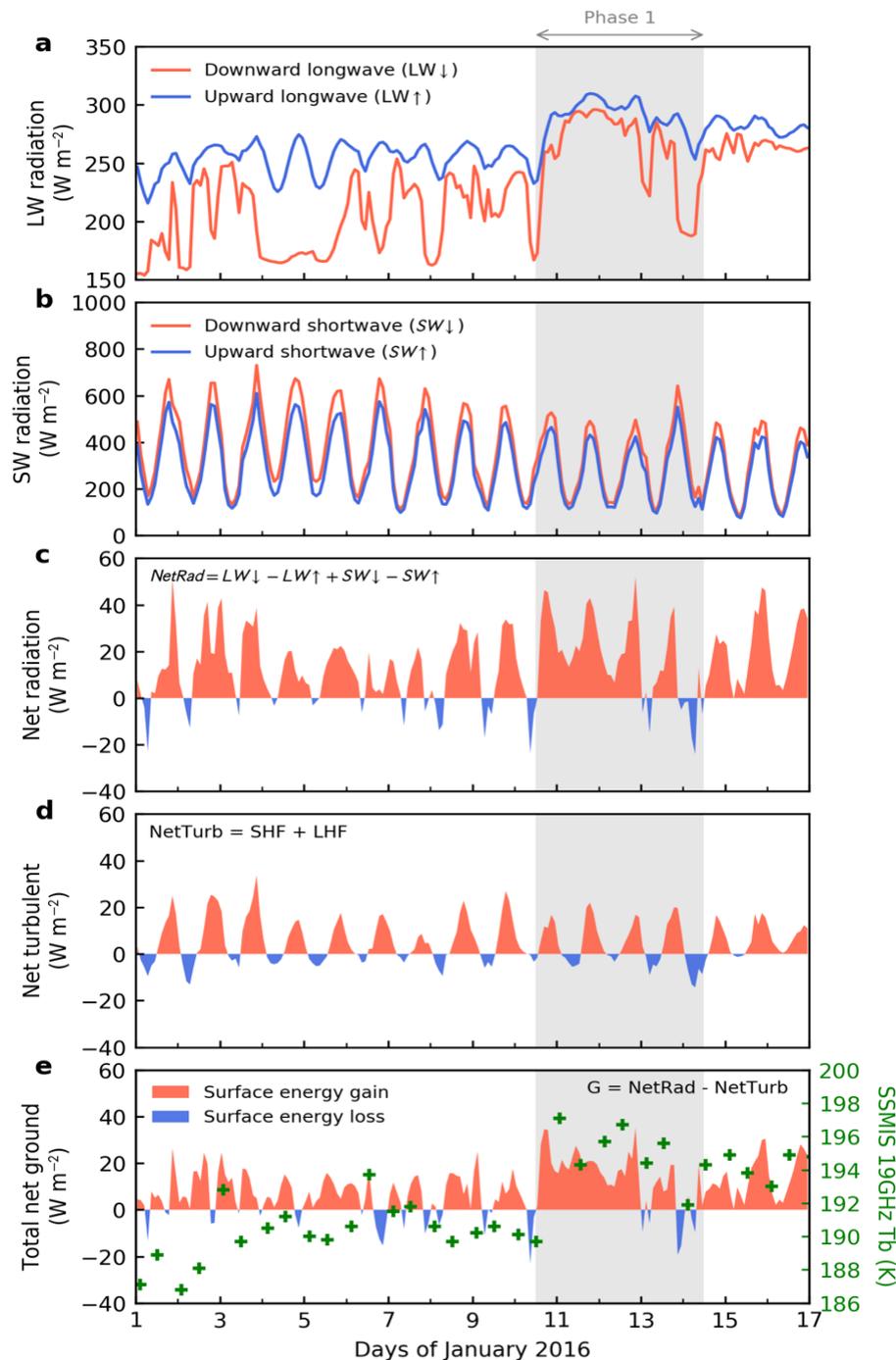


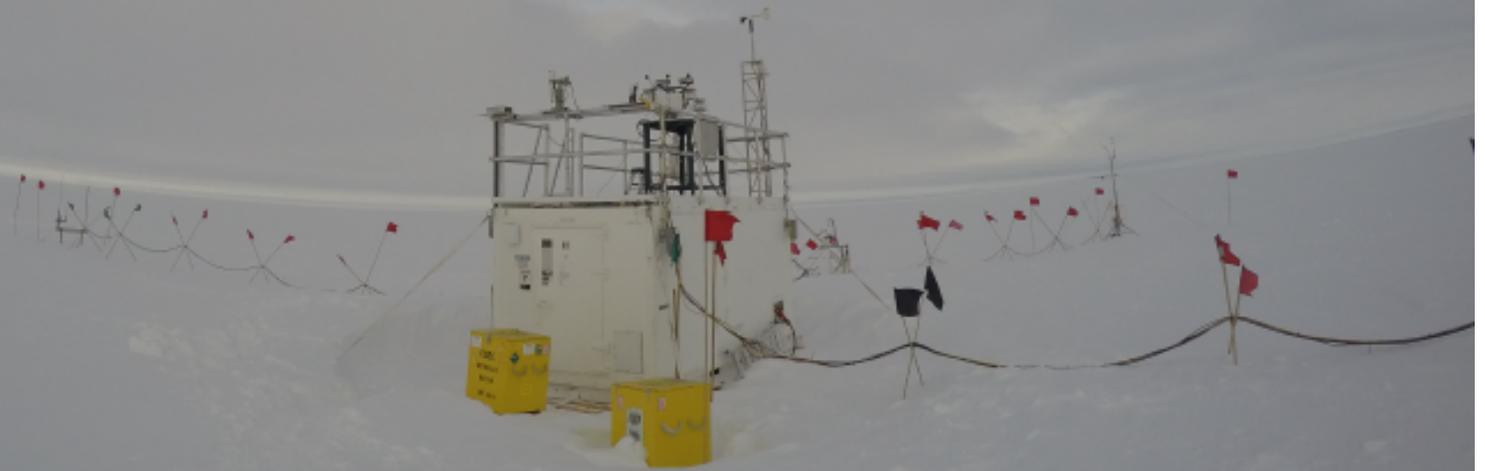
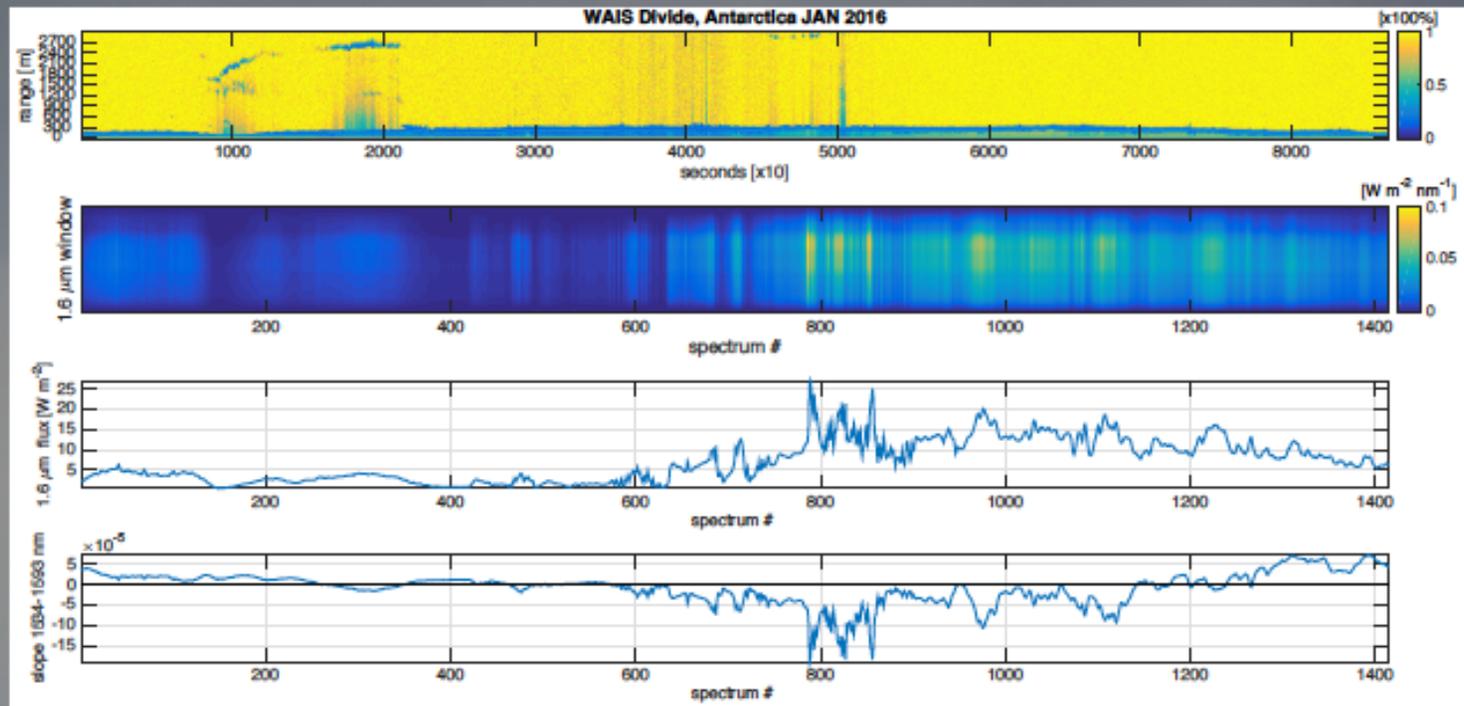
Melt Event AWARE Observations

Nicolas et al. 2017

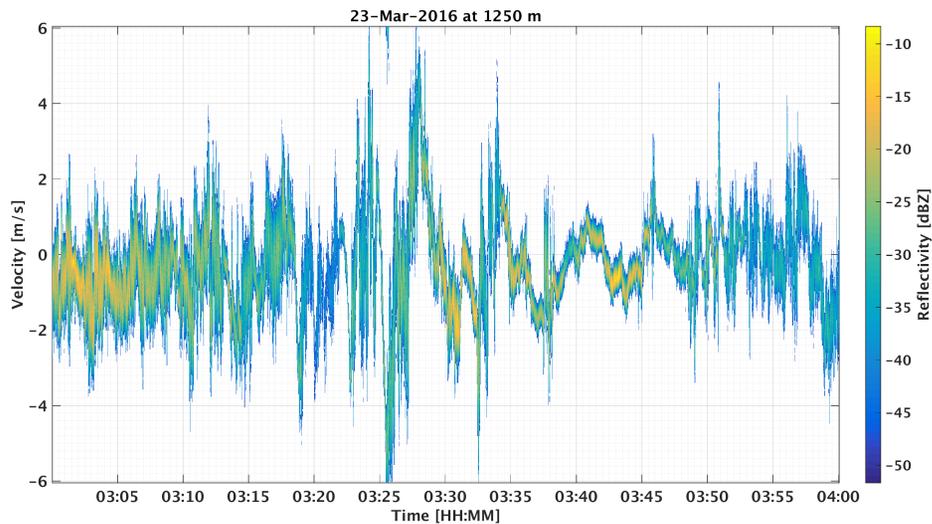
Nature Communications

- We successfully measured the surface energy components that induced a melt event in West Antarctica.
- Melt events are associated with ENSO, which is expected to occur more frequently in a warming climate.
 - Possible climate change implication but too early to make a firm conclusion.
- New state-of-the-art data with which to improve global climate model simulation.

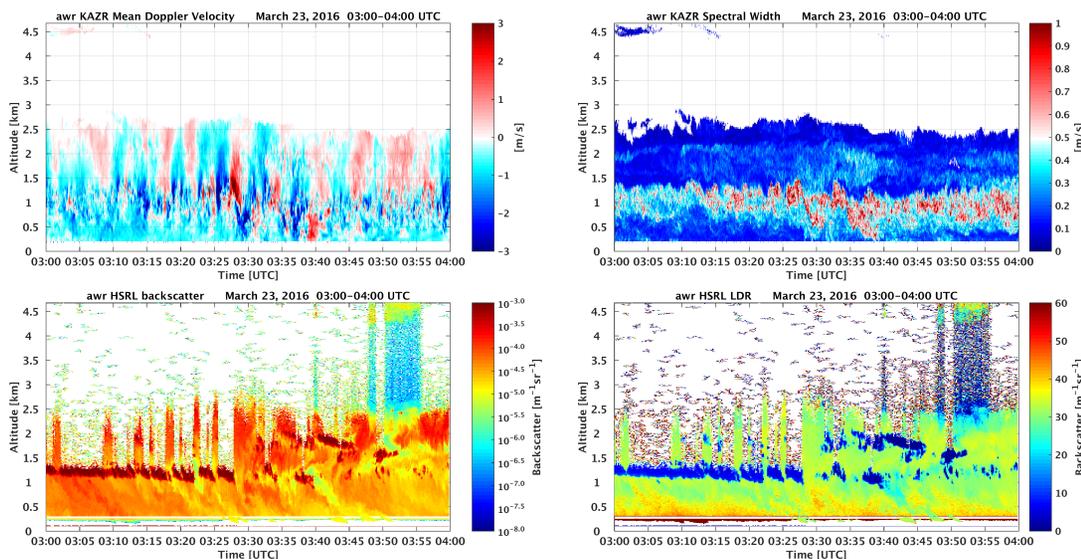




Moving Forward: Numerous Potential Case Studies in Polar Climate Significantly Contrasting with Arctic



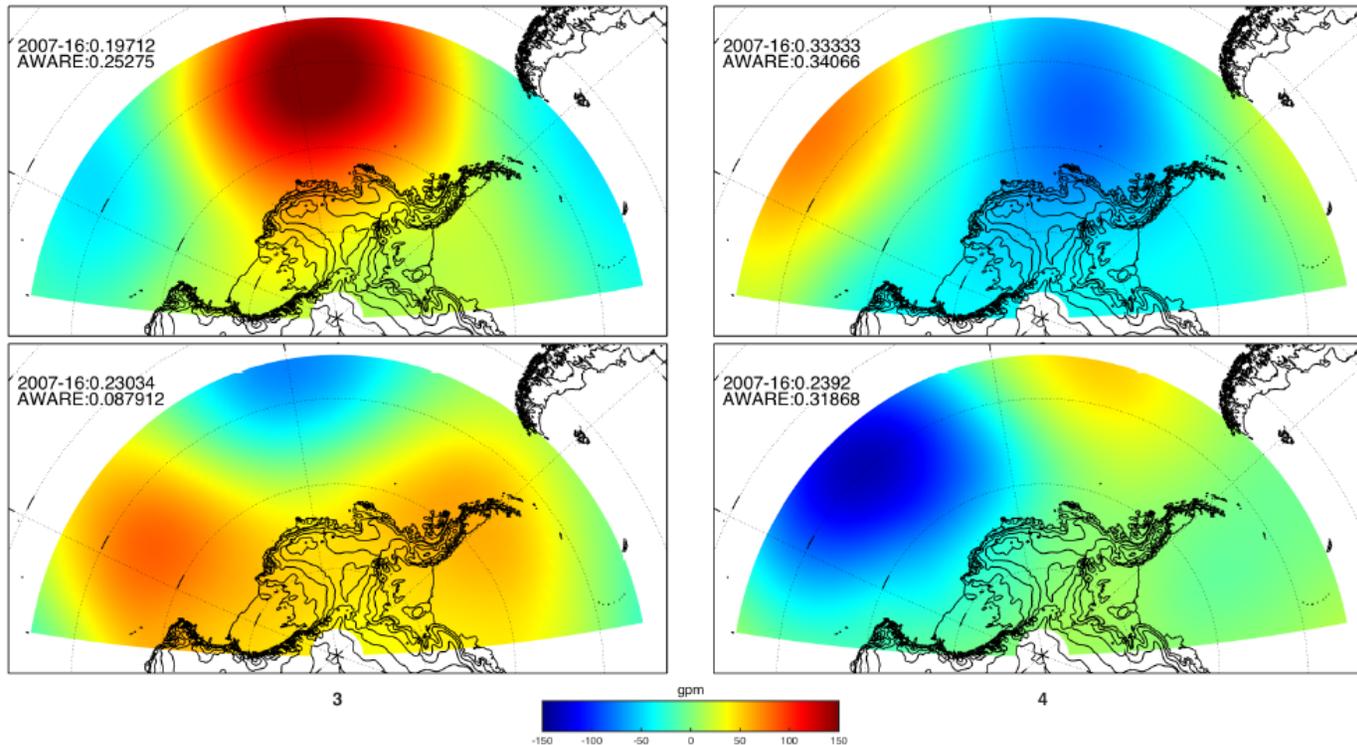
- AWARE radars sampled high vertical velocities and complex wave structure associated with orographic forcing from high terrain
 - cf. Scott & Lubin, 2016: *GRL*
- AWARE also sampled marine stratocumulus low in IWC compared with Arctic clouds
 - e.g., Grosvenor et al., 2012: *ACP*
- Agenda item for this session:
 - ✓ How to move forward with case study development and meeting modelers' needs?



Users Guide to AWARE Data

- Understanding Antarctic meteorology may be daunting for a researcher
- Are there recurring meteorological regimes influencing Ross Island?
- k -means clustering attempted on ERA-Interim 700 hPa GPH anomalies
 - cf. Mülmenstädt et al., 2012: *Journal of Climate*
 - Four stable clusters (regimes) emerge in each season
- Scott, Glennon, Wang, et al., 2018: *Journal of Climate*, in preparation

DJF



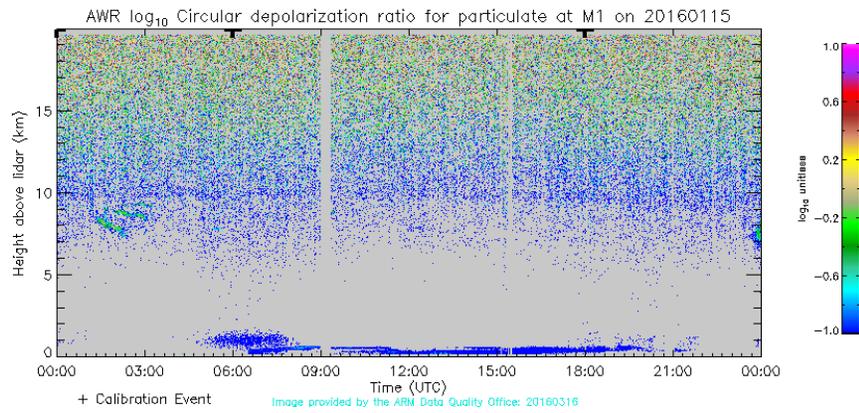
Users Guide to AWARE Data

	DATES	SYNOPTIC CONDITIONS	LOCAL METEOROLOGY AT ROSS ISLAND
CLUSTER 1	2015 DECEMBER: 9, 10, 11, 12, 13, 20, 21, 22, 23, 25, 25, 26, 27 2016 JANUARY: 1, 2, 6, 7, 8, 9, 10, 11, 12, 13, 14, 15 2016 FEBRUARY: No occurrence 2016 DECEMBER: 6, 10, 18, 19, 20, 22, 23, 24, 25, 26, 27, 28, 29, 30, 31	A prominent blocking high over the Amundsen Sea drives marine air advection and foehn wind-induced warming of Marie Byrd Land and the Ross Ice Shelf. Similar forcing triggered the January 2016 melt event sampled by AWARE (Nicolas et al. 2017).	Northerly-northeasterly flow brings warm temperatures and liquid-bearing clouds to Ross Island. The most likely airmass source region is the Ross and Western Amundsen Seas and the eastern Ross Ice Shelf.
CLUSTER 2	2015 DECEMBER: 1, 2, 3, 8, 18, 19, 28, 29 2016 JANUARY: 20, 21, 22, 23, 24, 25, 26, 27, 28, 29, 30 2016 FEBRUARY: 8, 11, 12, 13, 14, 15, 16, 17, 18, 19, 20, 21 2016 DECEMBER: No occurrence	A low pressure system over the Bellingshausen Sea draws continental polar air northward, promoting cooling of West Antarctica (cf. Nicolas & Bromwich 2011). At the same time, foehn warming occurs on the eastern Antarctic Peninsula.	This regime, associated with a positive SAM index, favors the coldest average summertime conditions at Ross Island. When present, clouds likely contain significant ice water. This is the most frequent pattern in the long-term and during AWARE.
CLUSTER 3	2015 DECEMBER: 14, 15, 16, 17 2016 JANUARY: No occurrence 2016 FEBRUARY: No occurrence 2016 DECEMBER: 1, 2, 3, 4, 5, 7, 8, 9, 11, 12, 13, 14, 15, 16, 17, 21,	A strong negative phase of the Southern Annular Mode (SAM) and a weak Amundsen Sea Low. Two ridging centers over the Ross Sea and the Antarctic Peninsula favor warming along their western flanks. Moderate foehn warming in Ellsworth Land.	Anticyclonic flow over the Ross Sea advects marine air from the western Ross Sea directly toward Ross Island, similar to the 2 nd case study presented by Scott & Lubin (2014). This is the least frequent pattern during AWARE.
CLUSTER 4	2015 DECEMBER: 4, 5, 6, 7, 30, 31 2016 JANUARY: 3, 4, 5, 16, 17, 18, 19, 31 2016 FEBRUARY: 1, 2, 3, 4, 5, 6, 7, 9, 10, 22, 23, 24, 25, 26, 27, 28, 29 2016 DECEMBER: No occurrence	A deep Ross Sea cyclone injects warm, moist air over Marie Byrd Land, which subsequently descends onto the southern Ross Ice Shelf (RIS). Especially warm T2m is observed on the southern RIS, downwind of the Prince Olav Mountains.	Cyclonic intrusions of marine air support a well-developed marine cloud band over West Antarctica. At McMurdo, strong southerly-southeasterly winds prevail, bringing ice and mixed-phase cloud systems influenced by local and remote orographic forcing, e.g., from the Transantarctic Mountains (Scott et al. 2017). This is the second most frequent pattern during AWARE.

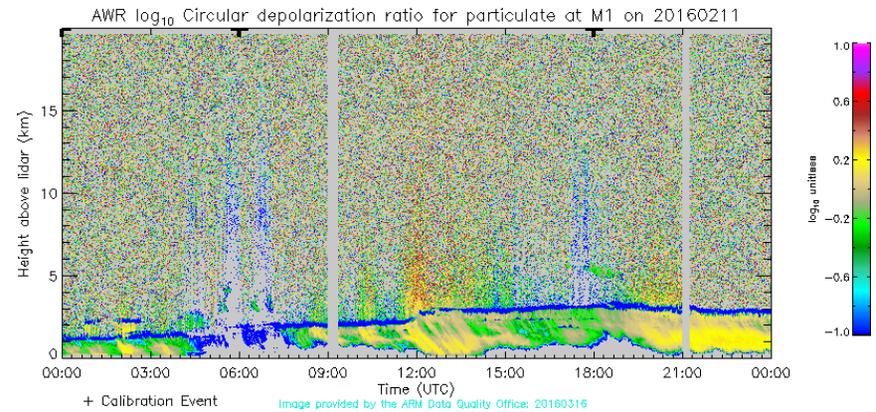
We will provide:

- Synoptic conditions for each cluster
- Effect of synoptic conditions on Meteorology at Ross Island
- Identification of each day with a cluster (a catalog)
- Statistics on best versus lower-confidence identifications
 - e.g., distances to cluster centroids
- Examples of HSRL, radar data illustrating each cluster in each season

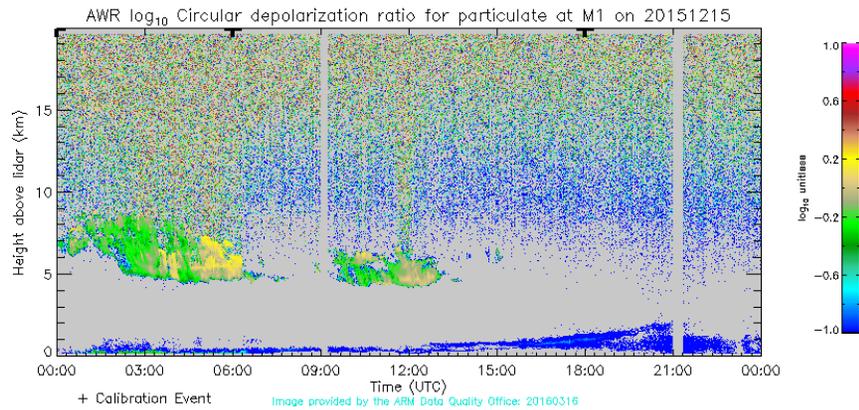
HSRL Daily Examples



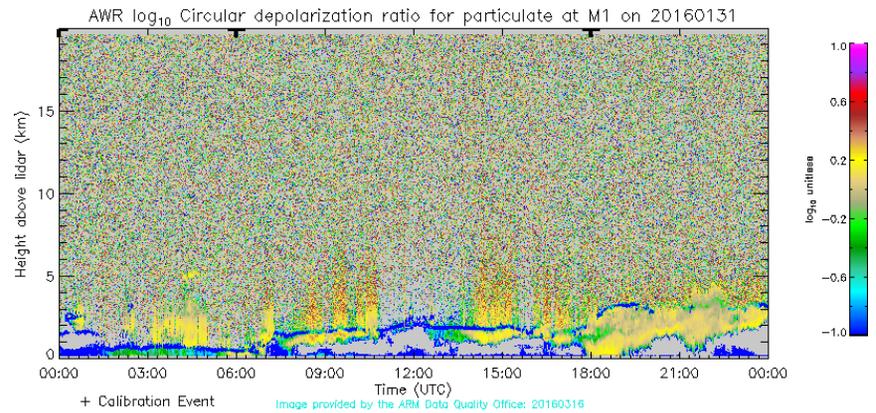
DJF Cluster 1



DJF Cluster 2



DJF Cluster 3



DJF Cluster 4

High Summertime Aerosol Organic Functional Group Concentrations from Marine and Seabird Sources at Ross Island, Antarctica, during AWARE

Jun Liu¹, Jeramy Dedrick^{1,2}, Lynn M. Russell¹, Gunnar I. Senum³, Janek Uin³, Chongai Kuang³, Stephen R. Springston³, W. Richard Leitch⁴, Allison C. Aiken⁵ and Dan Lubin¹

¹Scripps Institution of Oceanography, University of California, San Diego, 9500 Gilman Drive, La Jolla, CA 92093;

²Now at Texas A&M University, 400 Bizzell St, College Station, TX 77843

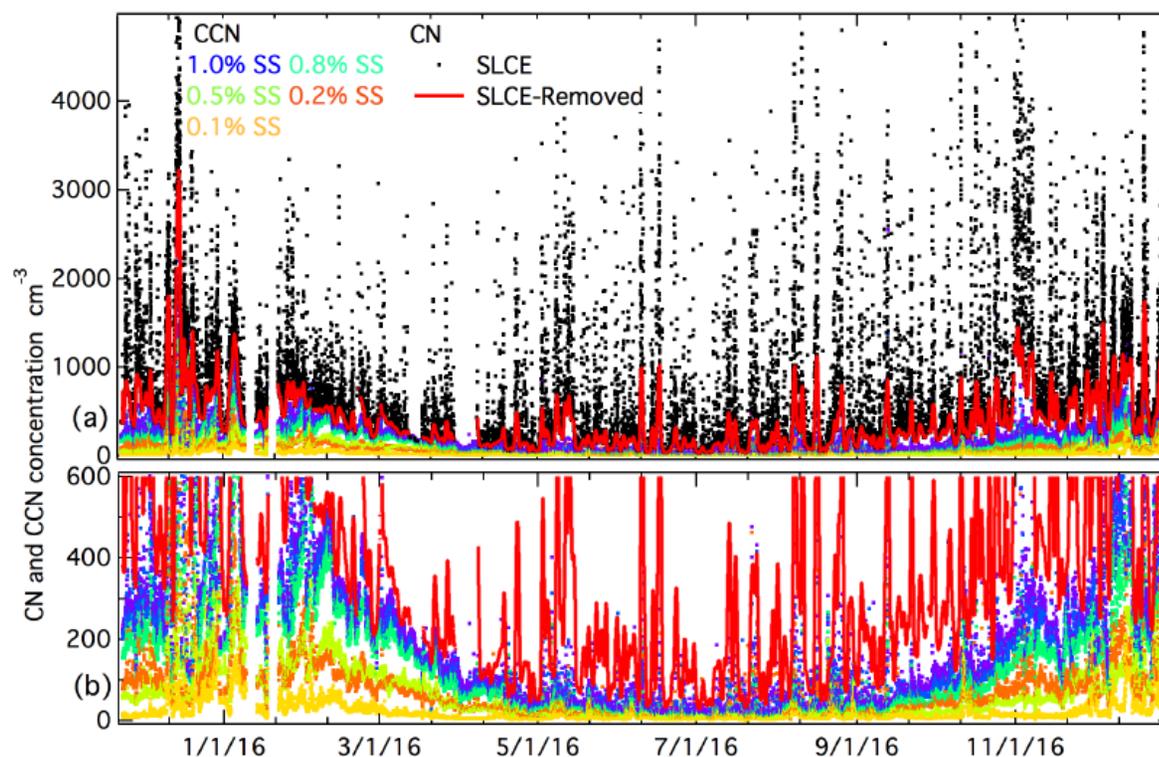
³Environmental & Climate Sciences Department, Brookhaven National Laboratory, Building 815-E, Upton, NY 11973-5000.

⁴Environment and Climate Change Canada (ECCC), Toronto, ON, Canada\

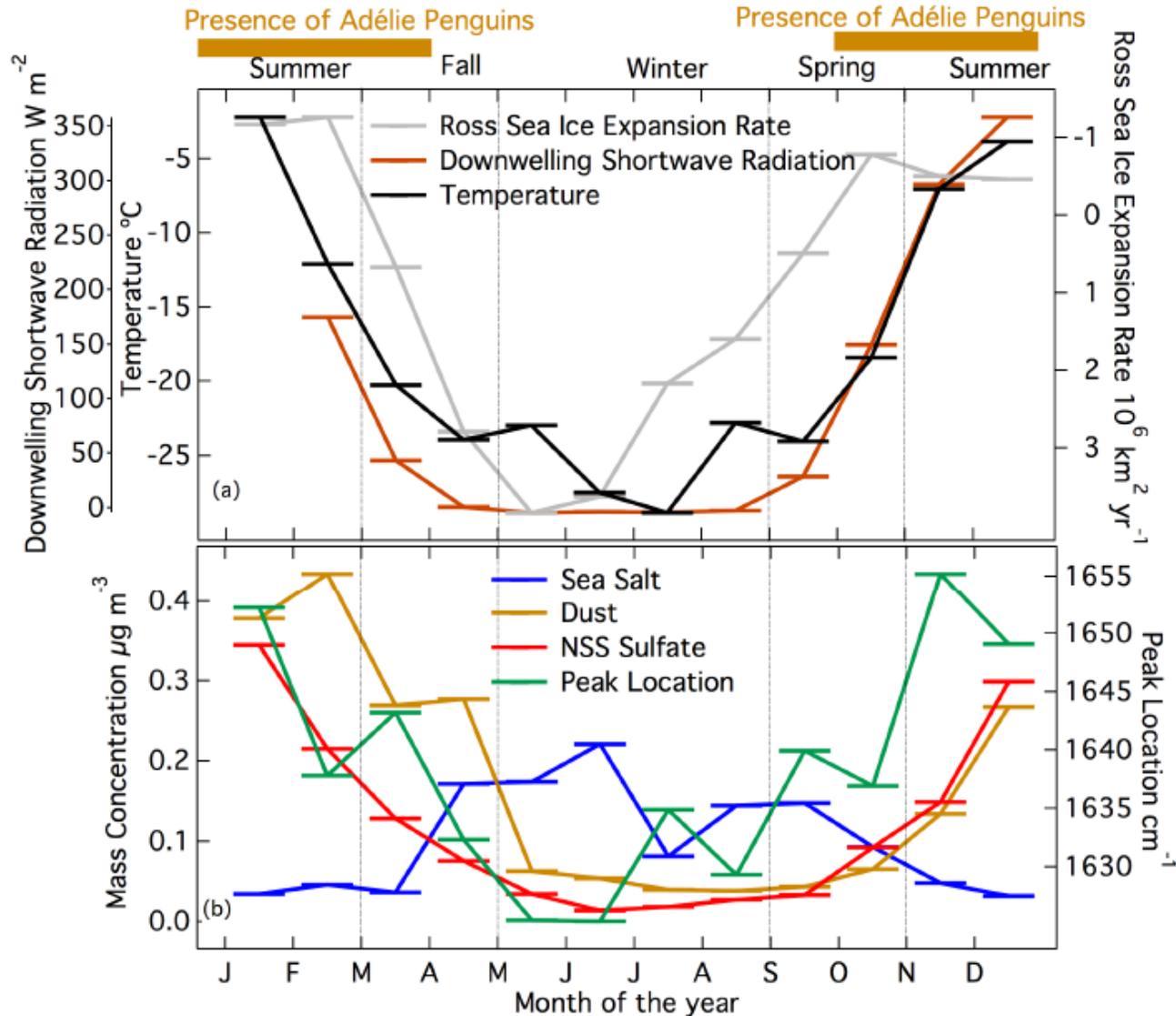
⁵Earth and Environmental Science, Earth Systems Observations, Los Alamos National Laboratory, Los Alamos, New Mexico, USA

Atmos. Chem. Phys. Discuss., <https://doi.org/10.5194/acp-2017-1225>

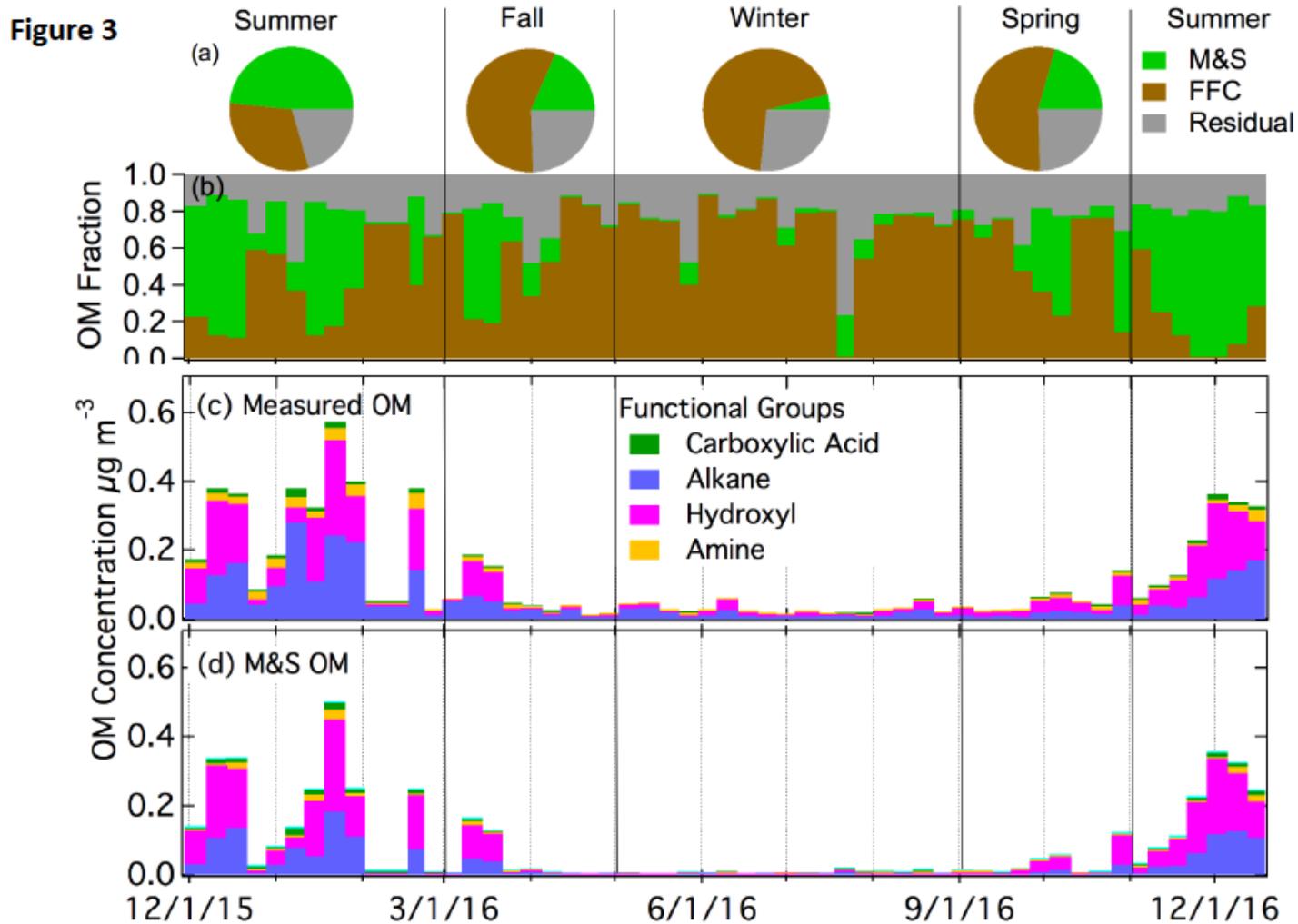
Applied numerical filtering techniques to identify local road vehicle contamination!



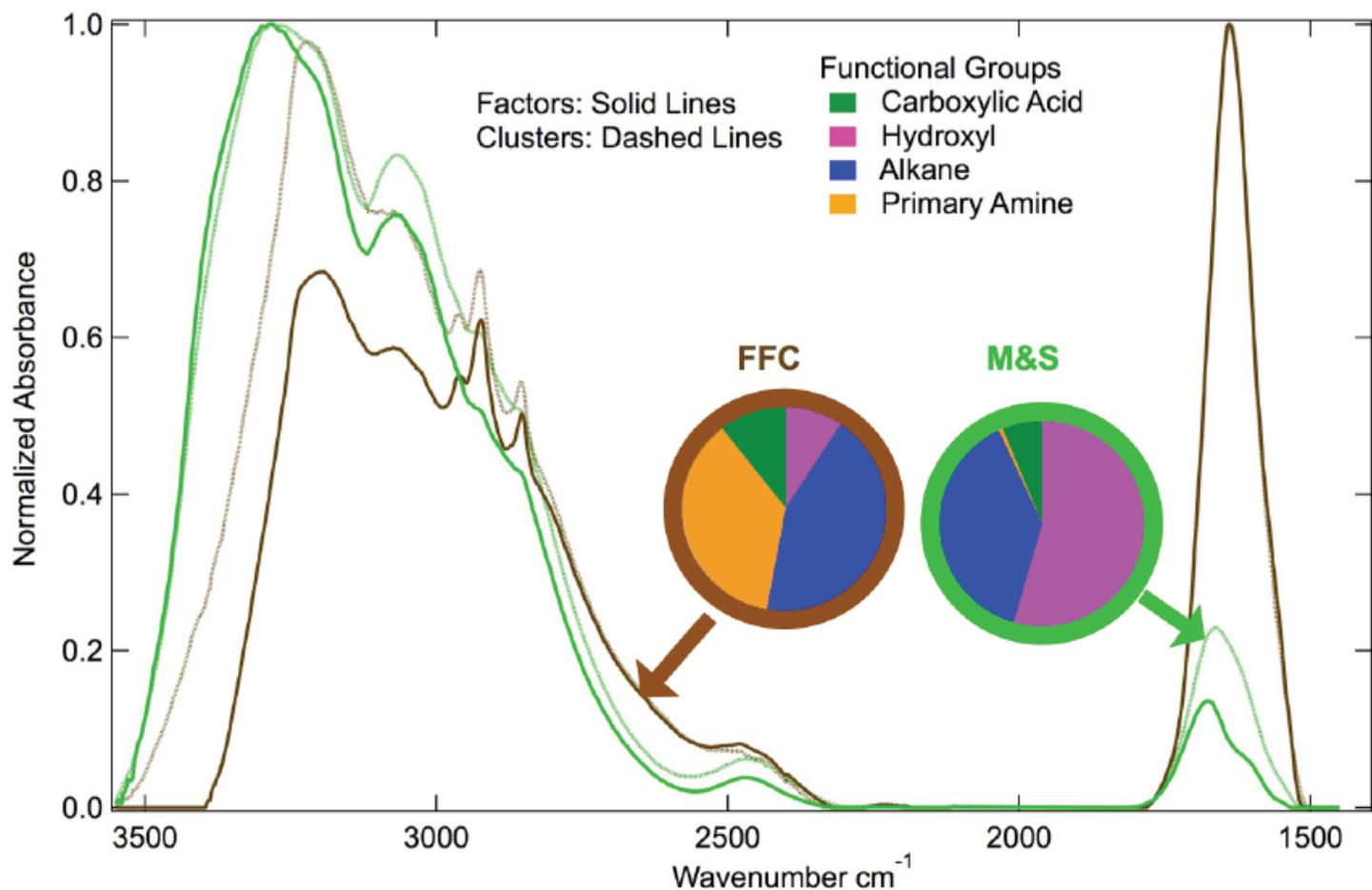
Annual Cycle of Aerosol Chemistry from Russell filter samples



Identification of Organics with Seabird Emissions (M&S) versus Fossil Fuel Combustion (FFC)



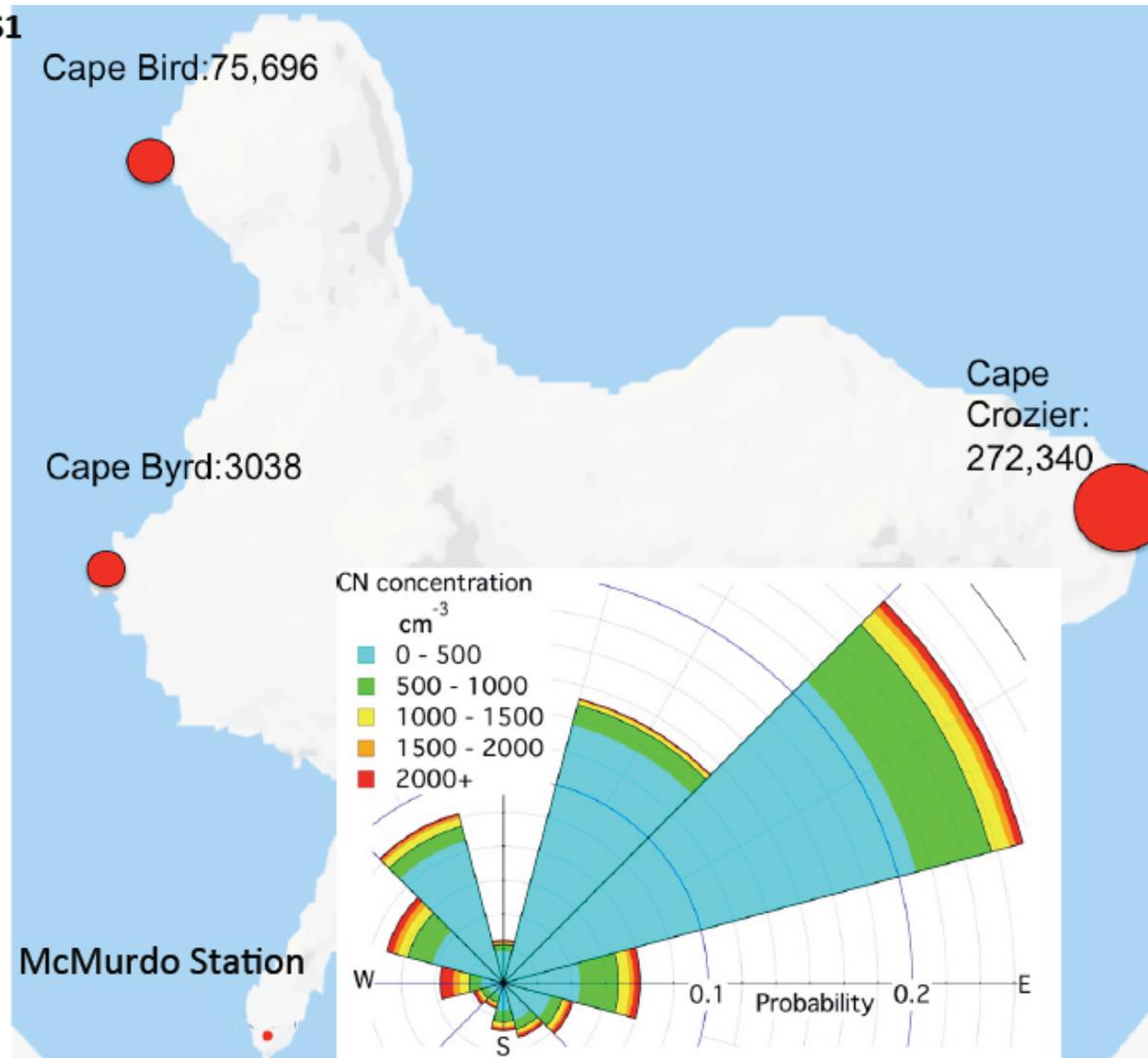
Identification of Organics with Seabird Emissions (M&S) versus Fossil Fuel Combustion (FFC)



From *k*-means clustering and Positive Matrix Factorization analyses of FTIR transmission spectra

Possible Local Source of Seabird Organics

Figure S1



(number of birds in the colony)

Topics for Discussion

➤ AWARE BAMS Article

- DL will submit proposal to AMS next week
- Coauthors welcome if they contribute a figure
- Science themes involve contrast with the Arctic
(need some new science content in addition to field program description)

➤ Develop and Implement Case Studies

- “Golden Days” will take some work to identify
- What are current MPC modeling issues amenable to AWARE data?
- How can the AWARE Science Team help you?
- How do we keep in touch and make progress?